# Journal of the Royal Society of Arts

NO. 4962 FRIDAY, 14TH OCTOBER, 1955 VOL. CIII

## *FORTHCOMING MEETINGS*

WEDNESDAY, 2ND NOVEMBER, at 2.30 p.m. Inaugural Address. '*Art in Education*', by R. W. Holland, O.B.E., M.A., M.Sc., LL.D., Chairman of the Council. Silver Medals which were awarded to lecturers in the last Session will afterwards be presented by the Chairman, and tea will then be served in the Library.

TUESDAY, 8TH NOVEMBER, at 5.15 p.m. COMMONWEALTH SECTION. '*The Gezira Board*', by Arthur Gaitskell, C.M.G., late Chairman and Managing Director, Sudan Gezira Board. Tea (for which there is no longer any charge), will be served from 4.30 in the Library.

WEDNESDAY, 9TH NOVEMBER, at 2.30 p.m. '*John Flaxman*', by John Thomas, M.A., Ph.D. Professor A. E. Richardson, F.R.I.B.A., President of the Royal Academy of Arts, in the Chair. (The paper will be illustrated with lantern slides and by a small exhibition of Flaxman's work in the Library.)

Fellows are entitled to attend any of the above meetings without tickets and may also bring two guests. When they cannot accompany their guests, Fellows may give them special passes, books of which can be obtained on application to the Secretary.

## *RESULTS OF THE OFFER OF ENDOWED PRIZES*

The Royal Society of Arts, in accordance with the terms of certain of its Trusts, this year offered three prizes under the terms set out below. The result of these offers is now announced as follows:

1. *Howard Prize for Mechanical Motive Power*

A prize of £50 was offered for a treatise on some aspect of the subject of mechanical motive power.

Seven entries were submitted, and on the recommendation of the judge appointed by the Council, Mr. J. S. Tritton, M.I.C.E., M.I.Mech.E., the prize has been awarded to Mr. W. C. Ikeson, M.B.E., A.M.I.Mech.E., M.I.Loco.E., M.Inst.Pet., for his essay on a new conception of the oil-fired steam locomotive.

The essay jointly submitted by Mr. D. F. Collins, B.Sc.(Eng.) and Mr. D. W. Thomas on comparison of the total weight and bulk of in-line naval gas turbine engines of differing degrees of complexity, was commended.

2. *Benjamin Shaw Prize for Industrial Safety*

A prize of £20 was offered for a description of any idea likely to increase industrial safety.

Nine entries were received, and on the recommendation of the judge, Mr. H. R. Payne, O.B.E., the prize has been awarded to Mr. A. E. Griffiths for his dust and swarf extractor.

Mr. R. C. Walsh's proposal for an expandable fireguard, and Mr. H. A. Holland's description of a safe method of 'climbing scaffolding', were commended.

3. *Fothergill Prize for Fire Prevention or Fire Fighting*

A prize of £20 was offered for a descriptive essay or model embodying some new idea for the prevention or suppression of fire.

On the recommendation of the judge, Mr. S. H. Clarke, M.Sc., Director of the Fire Research Station, D.S.I.R., the prize has been awarded to Mr. A. R. Broomfield, for his essay on a cheap fire-alarm system.

The essay by Chief Officer E. T. Hayward, O.B.E., M.I.Fire E., on fire-fighting in ships, and that by Chief Officer T. E. Smith, M.I.Fire E., on the protection of housing estates, were commended.

## *INDUSTRIAL ART BURSARIES EXHIBITION*

As announced in the last issue of the *Journal*, the winning and commended designs in the 1954 Industrial Art Bursaries Competition are at present on show at the Gloucester College of Art, Brunswick Road, Gloucester. The exhibition will open at the City of Canterbury College of Art, St. Peters Street, Canterbury, on 29th October, where it will remain until 12th November.

## *THE SOCIETY'S CHRISTMAS CARD*

An order form for the Society's Christmas Card for 1955 is included at the end of this issue of the *Journal*. The card has now been printed, and orders which have already been received are being executed as quickly as possible. A specimen can be seen at the Society's House, or sent on request.

# SCIENTIFIC RESEARCH IN INDIA

*The Thomas Holland Memorial Lecture by*

*PROFESSOR SIR ALFRED EGERTON, M.A., D.Sc., F.R.S.,*

*delivered to the Commonwealth Section of the Society on Thursday, 19th May, 1955, with the Right Honble. Viscount Waverley, P.C., G.C.B., G.C.S.I., G.C.I.E., F.R.S., in the Chair*

THE CHAIRMAN: It is a great pleasure for me to be permitted to take the chair for a most distinguished scientist, my old friend Sir Alfred Egerton; distinguished in many fields, thermo-dynamics, chemical technology, and latterly I have had many contacts with him in connection with fuel technology, which is a subject of extreme importance to our economy at the present time.

The lecture which he is going to deliver is the fourth in the series founded by Mrs. Runtz, the wife of the present Chairman of Council of the Society, in memory of her late husband Sir Thomas Holland, another very distinguished man of science who had a great career in India and subsequently became Principal of my old university, Edinburgh, where I had the pleasure of knowing him.

We look forward, I am sure, with very keen interest, to hearing what Sir Alfred has to say to us. I will not stand any longer between him and you, and now call upon him to deliver his lecture.

*The following lecture, which was illustrated with lantern slides, was then delivered:*

## THE LECTURE

When the Council of the Society did me the honour of inviting me to deliver the Holland Lecture on 'Scientific Research in India', I accepted with some thrill because of the opportunity it provided to present some impressions which two visits to India in recent years have made upon me. However, I reflected that there are many wonderful people who have spent their lives in the service of India who would be much more competent than I to speak to you. So in all humility I will say what I have to say on a very big subject, India—humanly the biggest member of the Commonwealth with its 360 million inhabitants scattered in about 500,000 villages; India—on which the sun shines with great vigour on its million square miles of land, delivering energy to the tune of about a thousand million horsepower; India—through whose valleys flow mighty rivers delivering water enough to irrigate much of the land, and to supply millions of kilowatts of hydro-power; India—with its precious resources: oil, coal, iron ore, mica, ilmenite, bauxite, zircon, manganese, gold and monazite sands, which are rich in thorium and uranium; India—rich too in wisdom rooted in ancient philosophy, with a spiritual tradition reflected in its art and culture.

My object to-day will be to provide information on that part of the recent efforts to use science to help in solving India's problems with which I have become acquainted; but I would not put it quite so narrowly. I do not think I could do better than quote the introduction to the report made last March

by the Committee which reviewed the work of the Council of Scientific and Industrial Research, and of which I was chairman. This was intended to indicate that it is not simply a question of applying science but of bringing science right into the picture.

> Disease, famine and war have been the three evils in man's path. Science is providing means to stem the onslaught of disease; science is pointing the way to supply the material needs of men and to allay the fear of famine; science is putting the fear of God in man and making aggression less alluring. Even if for a static population the needs of man could be satisfied, it would be of no avail if population increased at such a rate that famine, disease and aggression again assumed control. While science can help, science without the eternal virtues inherent in man will be of little avail. Nevertheless, the self-effacing discipline of science awakens in man these very qualities. Science is then the guiding star to man's future, displacing the darkness of superstition by the light of the laws of nature.
>
> Science sets no boundaries; her guidance is to humanity as a whole. The discovery of a universal law of nature, such as the laws of thermodynamics in the last century or the principles of indeterminacy in the present century, becomes the heritage of mankind, from which arise new powers to understand nature's ways and with it new responsibilities towards shaping man's destiny. Each country has its own difficulties to overcome and seeks the guidance of science to help in the solution of its problems. The careful statement of the problem needs a scientific approach and the countries which make use of science need, therefore, to have their trained scientists, their laboratories and up-to-date equipment, and the atmosphere in which scientific work can be done. By solving its own problems, one country can contribute to the welfare of another; this is in accord with the spirit of science.

The Prime Minister of India, on one occasion said: 'It is not easy to give a new face to so large a country which contains one fifth of the world's population. Perhaps the only way of doing this difficult job is by creating among the people a temple of science so that it takes away the rut of sluggish habit and ushers in an era of blissful prosperity'. As Mr. Nehru has seen, science holds the key to India's future. The great moral qualities which India possesses depend on age-long traditions: what is good in the old fabric has to be woven into the new, what is retained and what is abandoned will be for science to determine.

India has a plan—a five-year-plan initiated in April, 1951, to raise the standard of living of its immense population. The purposes were:

(*a*) to achieve as great an increase in agricultural production as possible; and

(*b*) to prepare for substantial industrial expansion.

This table gives some idea of the development schemes under the plan:

TABLE I

| | *Crores of Rupees* | *Per cent* |
|---|---|---|
| Agriculture and Community development | 361 | 17·4 |
| Irrigation and Power ... ... ... | 561 | 27·2 |
| Transport and Communications ... ... | 497 | 24·0 |
| Industry ... ... ... ... ... | 173 | 8·4 |
| Social Services ... ... ... ... | 340 | 16·4 |
| Rehabilitation ... ... ... ... | 85 | 4·1 |
| Miscellaneous ... ... ... ... | 52 | 2·5 |

The emphasis is on the irrigation schemes to increase in the five years the area under irrigation by fifty per cent, that is from fifty to seventy-six million acres, and to more than double the hydro-power to 3·2 million kilowatts. Industrial expansion was to be assisted more vigorously in the second stage of the plan. In the preliminary stage, expansion was intended to be met by private enterprise rather than through public expenditure. One of the objects which the plan set out to achieve is 'the development of a scientific temper in the people'.

This lecture is not on India's plan, though it is a great project and one which, it seems, is being effectively carried through with more rapid success than the plan which was despotically operated in the nineteen twenties by the U.S.S.R. Quoting again from our report, so as to indicate why I have mentioned the plan: 'Science has much to contribute towards the achievement of these projects. We understand, however, that research expenditure is only a small fraction of the 2·5 per cent under the heading "Miscellaneous".' It is not possible to outline the innumerable ways in which science can assist India's plan, but it is nevertheless important for us, in reviewing India's scientific effort, to recognize that the plan is in operation. Expenditure on research in India is still far less than the proportion of the national income which such countries as U.S.A. and United Kingdom are spending on research. Some people thought too much had been spent, but in comparison with the great industrialized countries, it was so far really quite little. It has recently been decided to increase expenditure for research.

The fruitfulness of science, however, is first and foremost not a matter of money, but of men, and very unique men (or women). One man suited to the problem will succeed where no amount of equipment, hands and even brains will suffice without the special gift. That gift often develops in a man because of the circumstances of his life. India has fructified and given that special twist to many a British scientist. Many, who became Fellows of the Royal Society, started in the service of India. I shall only mention two of such—an early Fellow of the Royal Society, born in the Western Colonies, was Governor of Madras for five years round 1690, and gave his name, Yale, to the great American University. Another very distinguished Fellow, living two hundred years later, Sir Thomas Holland, gave his name to these lectures, and it is a special privilege for me to be giving one of them, because he was a personal friend and a Rector of my College. Holland was appointed as a young man of 21 to the Geological Survey of India, and became the Director in 1903. He was a man of outstanding energy and initiative, and did great things for the development of India's mineral resources. He became Professor of Geology in Manchester in 1909, but returned to India in the first war, organized the Munitions Board and was on the Viceroy's Executive Council. He initiated the formation of the Indian Industrial Commission and, quoting from an article in the Indian Journal *Current Science*, 1943, 'how much more prepared would India have been if the chief architect of the report of this Commission had remained to implement it, and to provide the fully developed chemical and industrial sciences which it envisaged'. I quote this to emphasize how important is the *individual*. Nothing much happened

after Holland left in 1921, until Bhatnagar came on the scene twenty years later.

Nature, in the Indian scene, has set problems which have intrigued the minds of many British men of science, excited their vision and imagination, and activated them to exercise a certain genius of their own. It has done the same to its own men of science. A distinguished Indian engineer Ardaseer Cursetjee was elected a Fellow of the Royal Society in 1841; Ramanujam, in his short span of life, established a reputation as a mathematical genius of the highest order; Sir C. V. Raman, as a great physicist, Sahni, a distinguished botanist, and so on. There is no dearth of scientists of Indian nationality of high calibre. Perhaps one could remark that in the mathematical and physical sciences they have been particularly eminent.

Amongst the more outstanding of the Indian chemists was Sir Shanti Bhatnagar, F.R.S.—a man of quite extraordinary energy. It is of his work, not as a scientist—though he was an inspiring teacher and research worker particularly distinguished in colloid and magneto-chemistry—but as a scientific administrator of special genius that this lecture will be chiefly concerned. Bhatnagar was appointed Professor of Chemistry in the University of the Punjab, Lahore in 1924.

In the days of the East India Company, botanic gardens were established in various centres where the plants of India of value and interest could be collected and studied—the famous garden at Sibpur in Calcutta has such origin. Then under the Government of India the Geodetic and Trigonometrical Survey, the Meteorological Department and other scientific services were established. Nevertheless, the Industrial Commission, with which Holland had so much to do, reported, in 1918, that the position of research was quite unsatisfactory and that in its interests measures should be taken to promote it. Nothing very great happened: the Government of India established, in 1935, the Industrial Intelligence and Research Bureau with the object of laying the foundation on which a research organization could later be constructed. A council was formed, but the finances provided were meagre (about Rs. 2 lakhs). When the Second World War broke out the need for making India industrially self-sufficient was urgent, and in 1940 the Government established a Board of Scientific and Industrial Research. It was at this stage that Dr. Bhatnagar (as he was more frequently known in India in his latter days) was brought in from Lahore by the Viceroy, Lord Linlithgow, and he was appointed Director and Scientific Adviser to the Government of India. In 1941 an Industrial Research Utilization Committee was set up to advise generally on the methods of utilizing the results of researches and the terms of their release to industry. The laboratories of the director were shifted to Delhi in 1942. The Government created a fund called the Industrial Research Fund. and the Council of Scientific and Industrial Research was constituted as an autonomous body under the Registration of Societies, Act XXI (1860) to administer the fund.

The valuable work of the Council and the Director during the war, and the connections established with the leaders of industry, led the Government to make a grant of Rs. one crore for the equipment and construction of a chain

of research institutions. Even as early as 1942 proposals for a National Physical Laboratory and for a National Chemical Laboratory had been accepted.

The governing body of the Council, in December, 1943, appointed a Research Planning Committee, which pointed to the need for expansion of research activities and to get industry more closely interested. The Industrial Utilisation Committee was replaced, in 1947, by a more compact body, the Industrial Liaison Committee, and this has since been superseded (1953) by the National Research Development Corporation.

Although much was started before the attainment of Independence, it was after 1947 that scientific research got the full recognition and encouragement due to it. Scientific research was announced as a portfolio directly under the Prime Minister in August, 1947; the Department of Scientific Research was created in June, 1948, with Bhatnagar as Director; and the Ministry of National Resources and Scientific Research was set up in January, 1951, Bhatnagar becoming the Secretary responsible to the Minister. Under the stimulus of Mr. Nehru, the development of the whole scientific organization in India has been remarkable.

The pace of the establishment of the national laboratories was accelerated and new laboratories were planned and built. Bhatnagar's tremendous energy had full vent. He travelled far and wide to get information about the planning of laboratories. Concurrently with building, the best equipment was sought from many countries, staff was recruited and research started without waiting for buildings to be completed. The numerous scientific committees of the Board advised on schemes of research in many centres which were then assisted by the Council. Everything went ahead without waiting for finance; that, with

FIGURE 1. *Shri Jawaharlal Nehru*

*Sir Shanti Bhatnagar, F.R.S.*

Bhatnagar's powers of persuasion, seemed to come at the right time before any hold-ups occurred. During the five years following independence, 12 new laboratories were completed, equipped and established; 328 research schemes were financed, 207 Indian patents (and 21 foreign patents) were filed, and over a thousand research papers communicated.

Such was the history when I received a request last Christmas year to act as chairman of the Committee to review the work of the Council and to report to the Prime Minister. There had been a reviewing committee in 1947 of which Sir Ardeshir Dalal had been chairman; they had recommended that adequate arrangements should be made for pilot plant work in the national laboratories, that research schemes should be clearly defined by the Research Committees, that a National Development Corporation should be established and that a board of engineering research be set up under the Council. Action had been taken on all these matters.

I felt that for an Englishman to be invited to be chairman of the second reviewing Committee* was a courtesy and that the invitation should be accepted, so last February I arrived in Delhi and six weeks were allotted for the task. Our duty was 'to conduct a review of the Council's work and to take stock of the achievements during the past five years and to consider lines on which its activities should be developed and expanded in the future'.

Our first decision was to review as many of the laboratories as possible and obtain a general impression of the work being done in them. We had about a day for each place; we could, of course, only get a quick impression; the time which could be given was not at all related to the variety and importance of the work which the staff of each laboratory were keen to show us. The following is a list of the laboratories:

1. The National Physical Laboratory, New Delhi.
2. The National Chemical Laboratory, Poona.
3. The National Metallurgical Laboratory, Jamshedpur.
4. The Fuel Research Institute, Dhanbad.
5. The Central Glass and Ceramic Research Institute, Calcutta.
6. The Central Food Technological Research Institute, Mysore.
7. The Central Drug Research Institute, Lucknow.
8. The Central Road Research Institute, New Delhi.
9. The Central Electro-Chemical Research Institute, Karaikudi.
10. The Central Leather Research Institute, Madras.
11. The Central Building Research Institute, Roorkee.
12. The Central Salt Research Institute, Bhavnagar.

**Members of the Committee:*
Professor Gaston Dupouy, Director, Centre National de la Recherche Scientifique, Paris.
Professor S. N. Bose, Khaira Professor of Physics, University College of Science, Calcutta.
Sir Shri Ram, Industrialist, New Delhi.
Shri M. D. Chaturvedi, Inspector General of Forests, New Delhi.
Shri B. H. Batra, Chief Engineer, Post and Telegraphs, New Delhi.
Sir A. L. Mudaliar, M.D., LL.D., Vice-Chancellor, University of Madras.

TABLE I : COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

| Organization | Location | Date of Foundation-stone | Date of opening | Total expenditure up to 30-9-53 (Capital) (in lakh Rs.) | Annual recurring expenditure (1952-53) (in lakh Rs.) | Square footage of laboratory | Total number of staff | Ratio of Non-Technical to Technical staff | Name of Director | Name of the Deputy Director | Assistant Director (No.) | S. S. S. O. (No.) | J. S. O. (No.) | S. A. Senior & Junior (No.) | Miscellaneous Tech. Staff |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C.S.I.R. Secretariat | New Delhi | 8-2-1952 | 9-1-1953 | ... | ... | 30,500 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| National Physical Laboratory | New Delhi | 4-1-1947 | 21-1-1950 | 91.88 | 26.58 | 2,35,595 | 570 | 2:5 | Dr. K. S. Krishnan, D.Sc., F.R.S. | Dr. K. N. Mathur | 9 | 16 | 16 | 70 | 299 |
| National Chemical Laboratory | Poona | 6-4-1947 | 3-1-1950 | 77.90 | 20.50 | 1,83,510 | 297 | 4:11 | Dr. G. I. Finch, D.Sc., F.R.S. | Dr. M. Damodaran | 5 | 13 | 21 | 51 | 127 |
| National Metallurgical Laboratory | Jamshedpur | 21-11-1946 | 26-11-1950 | 52.66 | 52.66 | 1,00,500 | 262 | 4:9 | Mr. E. H. Bucknall, M.Sc. | Dr. B. R. Nijhawan | 3 | 7 | 14 | 29 | 125 |
| Fuel Research Institute | Jealgora | 17-11-1946 | 22-4-1950 | 32.87 | 12.30 | 57,084 | 486 | 5:19 | Dr. J. W. Whitaker, Ph.D | Dr. A. Lahiri | 2 | 13 | 17 | 81 | 270 |
| Coal Survey Stations | ... | ... | ... | 5.95 | 3.56 | ... | 125 | 1:15 | -do- | ... | ... | 5 | ... | ... | 3 |
| Central Glass & Ceramic Research Institute | Calcutta | 24-12-1945 | 26-8-1950 | 28.47 | 7.19 | 45,500 | 170 | 1:2 | Dr. Atma Ram, D.Sc. | ... | 2 | 5 | 7 | 15 | 82 |
| Central Food Technological Research Institute | Mysore | Building donated by Mysore Govt. | 21-9-1950 | 14.81 | 8.81 | 1,75,000 | 215 | 2:5 | Dr. V. Subrahmanyan, D.Sc. | ... | 1 | 9 | 12 | 43 | 85 |
| Central Drug Research Institute | Lucknow | Building donated by U.P. Govt. | 17-2-1951 | 24.16 | 11.80 | 55,000 | 138 | 1:3 | Dr. B. Mukerji, D.Sc., M.B. | ... | 4 | 8 | 20 | 28 | 43 |
| Central Road Research Institute | New Delhi | 16-9-1950 | 16-7-1952 | 26.00 | 5.92 | 56,235 | 105 | 2:3 | Dr. E. Zipkes, D.Sc. (Tech.) | ... | 5 | ... | 6 | 15 | 92 |
| Central Leather Research Institute | Madras | 24-4-1948 | 15-1-1953 | 30.26 | 4.29 | 94,350 | 126 | 2:3 | Mr. B. M. Das, M.A. | ... | 1 | 2 | 4 | 14 | 52 |
| Central Electro-Chemical Research Institute | Karaikudi | 25-7-1948 | 14-1-1953 | 23.10 | 2.67 | 67,800 | 112 | 3:5 | Dr. B. B. Dey, D.Sc. | ... | 1 | 1 | 1 | 20 | 47 |
| Central Building Research Institute | Roorkee | 10-2-1951 | 12-4-1953 | 20.92 | 4.29 | 52,000 | 98 | 9:5 | Dr. K. Bilir, D.Sc. (Tech.) | ... | 2 | 1 | 3 | 17 | 11 |
| Central Salt Research Station | Bhavnagar | Building donated by Saurashtra Govt. | 10-4-1954 | ... | ... | 16,100 | 34 | 9:8 | Dr. Mata Prasad, D.Sc. | ... | 1* | ... | ... | 6 | 9 |
| Central Electronics Engineering Research Institute | Pilani | 27-9-1953 | ... | ... | ... | 1,40,000 | 18 | 3:2 | ... | ... | 1* | ... | ... | 2 | |
| Central Mechanical Engineering Research Institute | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| | Total | | | 466.3 | | 2,993 | | | | | 37 | 89 | 121 | 390 | 1245 |

* Planning Officer

A table was inserted in our report which gives information about these places at a glance. The figures show that they were erected and got going extraordinarily quickly; they were spacious; the whole was obtained at a very reasonable cost—about Rs. 6 crores and 3·4 crores of assets (donations in cash, and in land and buildings); they were established with well-chosen staff, up to a complement of about three thousand, of whom about a quarter were scientific staff.

Some may have thought that the laboratories are on too large a scale in comparison with the size of the industries of India. At present that may be so, but they are there to help India to industrialize and as expansion occurs they will by no means be out of scale. Our printed report was presented by the Prime Minister to the House of the People, on 6th April last year.

May I take you next round the laboratories and institutes.

### THE NATIONAL PHYSICAL LABORATORY, NEW DELHI

This was a particularly fine building surrounded with lovely gardens. The laboratory has been very carefully designed for its purpose; elegant, well sited and supplied with sufficient land for all its likely needs in the next few decades. The air-conditioned auditorium, holding 840, in which large meetings can be held was a wise inclusion. There are few if any institutions of this character in the world which are so designed that the work is housed as conveniently. Most similar institutions consist of widely scattered buildings, which are consequently less easily directed.

It is not intended to provide facilities for routine testing. There are places for that in Calcutta and elsewhere, and there is an India Standards Institution. A National Physical Laboratory should 'set the standards of accuracy for the nation' (a remark made by Lord Moulton, F.R.S., when commenting many years ago on the work of the National Physical Laboratory, Teddington), but it should not become an establishment for routine testing for all and sundry. It can, however, be very useful in helping to raise the quality of the products of industry, and to avoid lack of uniformity or adulteration.

It is very fortunate that, at the outset, the laboratory has been able to have a man of such scientific eminence as Sir K. S. Krishnan, F.R.S., as its first director. Various lines of research of a fundamental kind were being pursued on the director's own initiative. It was interesting also to find progress in the direct utilization of solar radiation. This seems to be worth while, particularly if it can be employed to provide energy for the cooling of large buildings. Problems of air-conditioning and refrigeration are obviously of great importance in India and will need the attention of the laboratory.

The Director has an able Scientific Deputy Director and an Administrative Assistant, so that he can be as free as possible for his scientific work.

It was good to find that the laboratory was not trying to copy all that other National Physical Laboratories and Bureaux are doing, but to concentrate on those items which are most likely to serve India's needs. The National Physical Laboratory also forms the centre for Defence Research, and it houses the Central Science Library and Documentation Centre.

On our second visit to the laboratory it was the occasion of Bhatnagar's sixtieth birthday. I unveiled a portrait of Bhatnagar by an Indian artist which now hangs in the library of the laboratory, and referred to Bhatnagar as a master builder. Like the work of another scientist, Christopher Wren, there was a stamp of originality as well as a unity of conception about the whole series of laboratories that he had brought into being so incredibly quickly. The National Physical Laboratory was Bhatnagar's favourite of the many buildings and he had so made it that it would become a real centre of activity in India's capital, and indeed the auditorium is used for concerts as well as for meetings and entertainments. Science was to be set right to the fore in the social order.

The Prime Minister was present, and spoke at the meeting that day, in the auditorium, and afterwards joined the tea party set out in the beautiful garden. Looking back on this now, it is gratifying that Bhatnagar, who died suddenly on the 1st of January this year, should have experienced on his birthday such genuine expression of India's appreciation of his great work.

### THE CENTRAL BUILDING RESEARCH INSTITUTE, ROORKEE

Next we leave the National Physical Laboratory and take a long drive a hundred miles north of Delhi, *via* Meerut, to Roorkee to visit the Central Building Research Institute. This was a very good attractive modern laboratory, sited to be between Delhi and Dehru Dun, the great Forestry Centre, and alongside the Thomason Engineering College. Dr. Billig, the Director, was an Austrian engineer, particularly known for work on pre-stressed concrete. He had developed a shell house of cantilever construction suitable for tropical conditions. In any modern state, a place in which problems relating to buildings can be studied is a necessity. Each country has its own special problems. For instance, the supply of heat to buildings is a highly important matter in northern countries, but in India the removal of heat is of more importance. It was noted that a review had been made of the 'scientific principles underlying the design and construction of buildings in tropical areas'. There is much that can be done by further research in this field, which involves extension of physiological experiments as well as experiments on materials and the physical characteristics of buildings.

### THE CENTRAL ROAD RESEARCH INSTITUTE, NEW DELHI

India's roads are fascinating; they have not yet become runways for mechanical boxes like our modern roads. Indian life is there on the highway with all its colour and romance; pilgrims, bullock carts, families on trek, camels, elephants, monkeys. Fine trees of many varieties line the highways. There is usually a central track, some of which is now cement or bitumenized, with a soft dust-laden bullock track at the sides. The motor and the bullock cart are not good companions, neither is the rule of the road highly developed! In spite of the dust which is kicked up between the two, good temper seems to prevail.

The Central Road Research Institute is situated at a spot where the road to Bombay leaves Delhi. The traffic can be diverted along either one of two test

tracks which pass through the grounds of the Institute. Surface dressings of various kinds can thus be tested. There are many problems to be tackled, as distances are great; local materials must be used for road making. Local laterites of certain types can be used if treated by methods which the Research Institute has successfully developed. The Institute works closely with the Roads Organization of the Ministry of Transport, the Public Works Department of the Government, the India Roads Congress and the Standards Institution, and has proved not only useful as a means to investigate road problems but other problems relating to the use of cement, concrete, bitumen, and so on. In India the 14,000 miles of highway and part of the 250,000 miles of roads are mostly a public works responsibility: there is little done independently by large civil engineering contractors.

The C.R.R.I. has four large bays, each of floor space 7,700 square feet, at the back of the administrative block which has a library, museum, auditorium, canteen and conference room. The Institute has been in the active charge of Dr. E. Zipkes, a Swiss engineer, but his term of office has expired.

### THE TATA INSTITUTE OF FUNDAMENTAL RESEARCH, BOMBAY

On the way to the National Chemical Laboratory at Poona, we shall call at Bombay for a moment and visit Dr. Bhabha, F.R.S., at the Tata Institute of Fundamental Research. Dr. Bhabha is a nuclear physicist of international reputation who has recently been appointed Chairman of the International Commission for the Development of Atomic Energy for peaceful purposes which is to meet at Geneva. He is Chairman also of the Indian Atomic Energy Research Committee, and most of the work for the Committee is being carried out in the Tata Institute where there is a high energy accelerator and a betatron.

The Tata Institute expanded into the old Bombay Yacht Club building some years ago. A new large modern laboratory is being built for the work of the Atomic Energy Committee on the coast, but the cosmic ray and other interesting physical researches relating to Dr. Bhabha's work will continue to be done at the Institute by the young and very active group of research men that he has with him.

India possesses great resources of thorium and uranium concentrated by natural processes in the monazite sands of the south-eastern coasts. The necessary steps are being taken towards the expansion of chemical industry so that these ores may be treated.

### THE NATIONAL CHEMICAL LABORATORY, POONA

The National Chemical Laboratory is situated outside Poona City, not far from the University of Poona, nor from the big army training and educational centre. It is a very fine laboratory, excellently designed. There has been plenty of land acquired (475 acres). Housing accommodation can, therefore, be provided on the site. Laboratories, library, auditorium, museum, workshops, stores, offices, cafeteria and accommodation for the director, are all included in the main

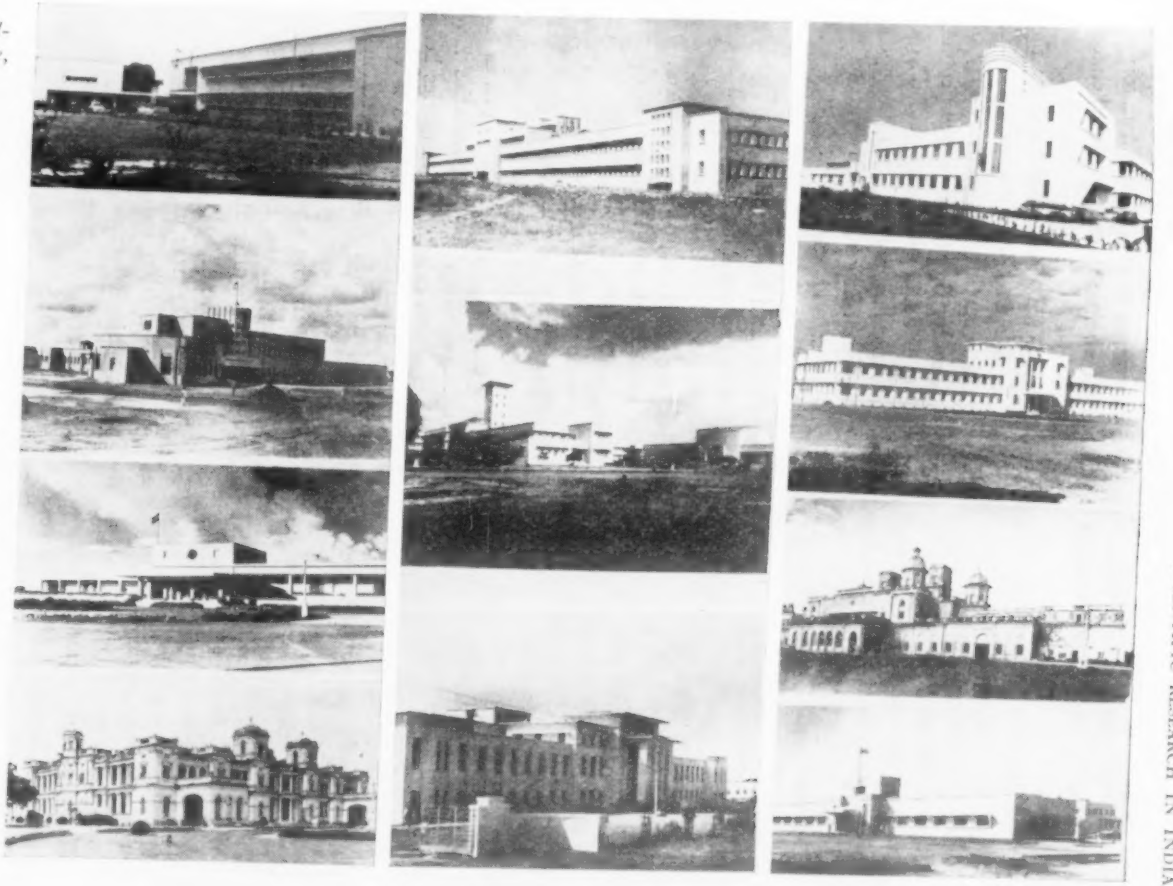


FIGURE 2

LEFT: *Central Building Research Institute, Roorkee.*
*Central Electrochemical Research Institute, Karaikudi*
*Central Road Research Institute, New Delhi*
*Central Food Research Institute, Mysore*

CENTRE: *National Chemical Laboratory, Poona*
*National Physical Laboratory, New Delhi*
*National Metallurgical Laboratory, Jamshedpur*

RIGHT: *Central Glass and Ceramic Institute, Calcutta*
*Leather Research Institute, Madras*
*Central Drug Research Institute, Lucknow*
*Fuel Research Institute, Jealgora, Bihar*

building. There is a small out-building in which pilot plant work is being done, but further provision for pilot plant operations was needed. The laboratory is very well equipped with modern apparatus for chemical and physico-chemical research.

The Director of the laboratory is Professor G. I. Finch, F.R.S., from the Imperial College, London. He succeeded the late Professor McBain, F.R.S., in 1952. The main object of the laboratory is being kept in view, namely to 'advance chemical science and to apply chemistry for the welfare of the people'. The progress of chemical industry depends on the pool of knowledge gained from fundamental work; if the pool dries up, industry has nothing to draw upon. We agreed with the Director that at least thirty per cent of the total effort of the laboratory could well be directed towards fundamental research work.

The Biochemical Division was under the able direction of Dr. Damodaran; many interesting studies in protein chemistry, and on fermentation were in hand. The National Collection of Industrial Micro-organisms is housed in the Institute.

In the Chemical Engineering Division the work is divided between the economics and costing of processes, pilot plant work and fundamental studies of general processes, such as drying, mixing, and so on. It is intended to extend the pilot plant work. This is necessary in a country where the chemical industry is not highly developed. India in 1948 employed only 1·8 per cent of its labour force in industry, and only 6·5 per cent of the national income was from factories. The industries of India are developing, but they need laboratories such as the National Chemical Laboratory to help them develop. The laboratories have first to gain the good will of those industries which exist. The industries being small are often not willing to undertake risks of development. This is where the National Research and Development Foundation which has been established can step in and help.

Many different investigations were in hand in the chemical engineering section, in the Division for Inorganic Chemistry, in the Division of Organic Chemistry, in the Division of Physical Chemistry, and in the Division for the study of Plastics and Polymers. The Chemical Laboratory is alive with work of such a varied kind that it is not possible to refer to it in detail here. About 150 enquiries on technical subjects are received from industry every month and are attended to through a special branch of the laboratory.

There is no doubt that this laboratory can become a great centre of chemical research, but we felt that it would be necessary that there should be close connection with university centres, so that post graduates could come to do research work in the laboratories for their higher degrees when the subject of the work seemed suitable. It was good to learn that collaboration with the University at Poona had been established, and that members of the staff of the laboratories have opportunity to teach their subject at post-graduate level in the university.

It is very important in laboratories with a set establishment that there should be a continual revivification taking place. In many universities this occurs naturally; young men of distinction, as they graduate, come to research and if

they show special promise are found places on the staff or move out to posts as lecturers at other universities. There is a continual flow and refreshment, bringing with it the fructifying ideas of the young mind, centred round the professors or leaders of research. That is a very desirable state of affairs in which research can flourish. University research is centred round the chair; if the professor changes, the special branch of subject also changes.

It is less easy to provide for flexibility in an establishment. An establishment—a national laboratory or research institute—is organized round the subject. The director has to be a specialist and the staff have to be experts in the subject with which the institute deals. If, however, the director wisely does not always fill up all the posts available for his full complement of staff, and if he is in close touch with industry, universities and other bodies so that he can recommend research men for jobs elsewhere when suitable circumstances arise, then a flow can be maintained and incentives for fairly rapid promotion can be provided. Promotion should always take into account capacity and application. One has however to qualify these observations. An establishment cannot well afford to lose all its experienced men, and it cannot retain them unless a certain security of tenure can be provided.

### THE INDIAN INSTITUTE OF SCIENCE, BANGALORE

We now go on to Mysore, calling this time at Bangalore on the way. The Indian Institute of Science at Bangalore was founded by Sir Jamshed Tata early in the century. He had obtained the advice of the Professor under whom I studied at University College, London, Sir William Ramsay, F.R.S. Professor Travers, F.R.S., who worked with Ramsay in the discovery of the rare gases became the first Director of the Institute. Later, Sir John Simonsen, F.R.S., lent distinction to the Department of Chemistry as its Professor. The Institute is partly supported by the Tata and other endowments, and partly from government sources. It has played a great part as almost the chief centre of research in India in the physical, chemical and engineering branches of science; it also provides education at the undergraduate level in electro-technical and other subjects. I was asked to be chairman of a small committee to review the work of the Institute in 1948, and the other members were Sir Ben Lockspeiser and Dr. J. N. Mukherji. We felt that, although the Institute was not organized quite on the same lines as a higher technological college, such as Massachusetts Institute of Technology or Imperial College, London, it was nevertheless largely performing the function of such institutions and could well develop in such a way. Our recommendations were carefully considered in the ensuing year and most of them were put into effect. It was interesting to stop at the Institute on our way and to be shown some of the many developments there by the distinguished Director, Dr. Thaker, who is a well-known authority in power engineering. Sir C. V. Raman was a past Director of the Institute, and much of his work had been done in the Physics Department. He now has an attractive laboratory on the highest piece of ground in Bangalore from which he can survey the scene and which has been provided for him by private subscription. There

he has installed his wonderful collections of minerals and coloured objects, and is happily continuing his studies along with some of his assistants.

### THE CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE, MYSORE

Mysore, about a hundred miles from Bangalore, is certainly one of the most beautiful and clean of small cities anywhere to be found, and one of its many palaces—the Chelavamba Mansion—has been acquired as the gift of the Mysore Government for the Central Food Technological Research Institute along with a considerable amount of land. There are eight divisions to the Department: Biochemistry and Nutrition; Food Storage and Preservation; Food Engineering; Food Processing; Microbiology and Sanitation; Fruit Technology; Quality Control; Food Information and Statistics.

The Director of the Institute is Dr. Subramanyam, a well-known food technologist. The palace is spacious and for much of the work has been well adapted, but the processing machinery and workshops need a less incongruous kind of housing and plans were in hand for building a new technological block.

The Institute is engaged on problems of great importance in a country growing food and consuming food on so large a scale as in India. Investigations are carried out on the properties of known and unfamiliar foodstuffs, the development of new processes and products, and on problems of food preservation under Indian conditions. It is a big field, and the Director has enthused his staff with activity. Much was being done to establish an Information section, because the work cannot be effective unless the knowledge is spread.

The work is so diverse that little impression can be given of it. Amongst many other things the Institute has developed a composite flour mixture, known as 'Mysore Flour', consisting of a mixture of tapioca and groundnut flour which could relieve famine. The partial replacement of rice, wheat and other grains with tapioca, which yields three or four times as much starch per acre as cereal grains, can also help to reduce wheat importation. The Institute has experimented on the effect of such replacement and has shown that the health of growing children does not deteriorate in consequence. There has also been developed a 'synthetic' or vegetable butter milk. This is made from groundnuts and was used to feed children in distress areas.

The Institute provides a diploma course in fruit processing technology and is equipped for this purpose. It also carries out a considerable amount of testing and examination of food products in relation to control orders. Six hundred factories depend on the Institute for advice on standards of quality.

### MINING RESEARCH INSTITUTE

On the way to Madras one flies over the Kolar Gold Fields, one of the world's deepest gold mines. The problems of mining in India, particularly coal mining, are going to be centred in a Mining Research Institute which is being erected near Dhanbad, and of which Dr. J. W. Whitaker, who was until recently Director of the Central Fuel Research Institute, is in charge of the planning. When we

visited Mysore, Dr. Bhatnagar had been helping to inaugurate a big new development at Nagpur; a plant for the beneficiation of low-grade manganese ores, which promises to be of such value, so it was said, that it might pay many times over for all the expenditure which the Council of Scientific and Industrial Research had incurred.

Sir Shanti Bhatnagar's energy was such that as we went day to day from place to place round India's wheel he went up and down to and from Delhi on the spokes, and somehow managed to be present at nearly every centre we visited!

### THE CENTRAL LEATHER RESEARCH INSTITUTE, MADRAS

Madras is an educational as well as an industrial centre. The University, the Medical Centre, the Engineering College, and the Alagappa Chettiar College of Technology are well known. Leather being a great industry in the south of India, the Leather Research Institute is well placed at Guindy next door to the Technical College. It is a big fine laboratory with another rather similar building to house the model tannery.

The Institute's work is divided into (*a*) chemistry and physics, (*b*) biology, (*c*) tanning and finishing, (*d*) information, (*e*) chemical engineering. The Director, B. M. Das, is a well-known leather technologist, who was a pupil of Professor H. R. Proctor at Leeds many years ago.

Indian vegetable tanning largely depends on imported wattle bark and mimosa extract, apart from local avarum. It is necessary to find indigenous tanstuffs and the use of other barks has been investigated. The measurement of pH has made possible the substitution of mangrove bark for wattle bark. The indigenous process of tanning used by South Indian tanners has been shown to be open to great improvement, and the cost of tanning has been considerably reduced. Improvements in salt treatment for the curing of skins for export have been made and the trouble due to hardening has been eliminated. The physical chemistry of the tanning processes is being kept well to the fore in all the work of the Institute. A process for depilating by using proteolytic enzymes from the latex of akand leaves had been devised which greatly reduces the time required and improves the quality of the leather in comparison with the lime process which involves a further process of bating.

The tanneries are taking advantage of the Institute's model tannery in finishing their products. There is no doubt that this Institute is doing a fine job of work and will have a direct effect on the development of India's leather industry, both in regard to its cottage and large-scale working.

### THE CENTRAL ELECTROCHEMICAL RESEARCH INSTITUTE, KARAIKUDI

Down in South India, at Karaikudi, there is another institute, the Central Electrochemical Research Institute. It is not exactly central! It was not possible for us to pay it a visit, but the Director, Dr. B. B. Dey, came to Madras to discuss its affairs with us. Dr. Alagappa Chettiar, a very philanthropic man, donated land and money for this institute, which is in the vicinity of the Alagappa

Chettiar Technical College and Anamalai University. The Institute is a fine place. With suitable arrangements for keeping in touch with the National Chemical and Metallurgical Laboratories and the related industries, it should prove to have influence on many future developments, such as the production of heavy water. Dr. Dey gave an account of the problems which were being studied at the Institute, among which may be mentioned the production of high-purity electrolytic manganese.

### THE CENTRAL GLASS AND CERAMIC RESEARCH INSTITUTE, CALCUTTA

We next fly on to Calcutta. We visit hurriedly the Bose Institute, a centre of biophysics, where genetical work is being carried out on the exciting effects of radiations in causing biological changes, then the university laboratories where S. K. Mitra's work on the upper atmosphere is centred, the Nuclear Research Laboratory, of which Professor Saha was in charge, and the Institute of Statistical Research in which Mahalonobis' well-known work is centred. But it was the Central Glass and Ceramic Research Institute we had come to inspect in the Calcutta district. Of the smaller laboratories this was one which Bhatnagar considered a particularly happy design, and we could well agree. It is a beautiful modern laboratory in L form, containing library, museum and offices. There is also a technological block for processing raw materials and for furnaces and workshops.

Professor W. E. S. Turner, F.R.S., the well-known expert in glass technology from Sheffield, had spent some weeks at the Institute just before our visit and had written a glowing tribute to the work of the Institute and stated that 'the Institute will not only be important in the present needs of the glass industry but would also lead to the establishment of new industries and stimulate a scientific approach in the different branches of the industry with which the Institute is concerned'.

'Do it now, I am not interested in excuses for delays, get on with it', is a message by the Prime Minister exhibited in the hall of this Institute. It seems to have inspired the Institute to 'get on', for a great amount of work has been accomplished in the short time since it had been opened. Like the Leather Institute it seemed well integrated with the industries it serves. This is largely due to its energetic Director, Dr. Atma Ram, and his able staff.

Glass sands are available throughout India; many of the poorer grades can be improved by the washing, heat treatment and magnetic separation processes which have been developed in the Institute. Work has also been done on clay, felspar and talc resources in collaboration with the Geological Survey, the Bureau of Mines and State Geology Departments. A satisfactory vitreous enamel containing titanium had been evolved which avoids the importation of borax for enamelware. Dr. Atma Ram and his staff were very active in giving assistance to the glass and ceramic industries and legislation should be such that the industries would be encouraged to develop more quickly processes and products which the Institute had shown to be of national advantage.

### THE NATIONAL METALLURGICAL LABORATORY, JAMSHEDPUR

The firm of Tata has for long operated one of the largest steel works in the Commonwealth at Jamshedpur, situated about half way between the great centres of coal and of iron ore in Bihar. Alongside these great works is the next great research centre—the National Metallurgical Laboratory. This is the third largest of the Council's new laboratories.

The total iron and steel production of India is of the order of one million tons, of which nearly half is produced at Jamshedpur. The total requirement of India for steel, as stated in the plan, amounted to about three million tons, but recent news indicates that further large plants are to be erected with a total output of six million tons. This is an indication that India's expansion is going forward rapidly. The assistance that can be given by a research centre for metallurgical research is obvious if the industry is to expand.

The Institute has a large main building and a technological block for large-scale operations and pilot plant work. The laboratory is under the direction of Mr. E. H. Bucknall, one time a member of the staff of our National Physical Laboratory and distinguished for his work in ferrous and non-ferrous metallurgy.

Interesting studies on nodularization in cast irons have been made and are continuing. An alloy of copper and magnesium introduced into cast iron causes graphite to be formed in nodules and, on annealing, the cast iron has high ductility. The beneficiation of manganese ores has been investigated and has led to important developments.

### CENTRAL FUEL RESEARCH INSTITUTE, JEALGORA

Next we hurry on to the Central Fuel Research Institute at Jealgora near Dhanbad in Bihar. A fuel research institute is essential to any country which produces fuels. The Fuel Research Institute has been under the direction of Dr. J. W. Whitaker, who has been a very successful director. The post of Executive Director is now filled by his able deputy, Dr. A. Lahiri.

The Institute consists of a main block in which there is a large enough assembly room and a museum. Besides the main block, there is another building behind the main building for coal and coke testing work, and other physical and chemical research. Two limbs of the administrative block are under construction and these, when completed, will provide the much needed floor space for special research laboratories. The technological block is situated a little way off (200 yards) from the main block. Sufficient area has been set apart for pilot plants relating to steam raising, carbonization, coal preparation, pulverized fuel, and so on.

The annual coal production of India is about 35 million tons. It is mainly required for Indian railways (10 million tons) and for provision of coke for the metallurgical industries ($4\frac{1}{2}$ million tons); only about one million tons are exported. The output is thus quite large and the need for coking coals will become greater as industry expands.

The Director co-ordinates, at the central laboratory, the work of the five Coal Survey Stations situated in different coal fields and also the work of the

Hyderabad Coal Survey. The coals of India are of particular interest and importance for the geological and petrographical study of the origin of coals so that the work of these survey laboratories is not only of economic importance to India, but to coal science generally. The Assam coals, which are high in sulphur, are young and may throw further light on oil and coal formation, while the Jharia coals are probably redeposited drift coals which accounts for the mineral matter being so closely associated with the coal substance. The ash content of these coals is high. Coals from different parts of the world are different in structure and behaviour, so special problems arise as to their utilization in the different countries in which they occur. Coal washing, breaking and carbonization offer different problems in different districts. The Institute has contributed to new methods of analysis of coals, particularly for nitrogen and phosphorus, and thereby to the international standardization of methods.

Altogether the Fuel Research Institute was fulfilling admirably the purpose for which the C.S.I.R. set up national laboratories and institutes, and its influence in industry was becoming more and more appreciated.

Near Dhanbad is the big fertilizer plant manufacturing 750 tons of ammonium sulphate daily from gypsum, which is brought by rail from Rajputan. It has been decided, so I understand, that other plants are to be erected to increase the supply four-fold as soon as possible.

### CENTRAL DRUG RESEARCH INSTITUTE, LUCKNOW

A further journey brings us to the historic and beautiful city of Lucknow. Here the Central Drug Research Institute is suitably established close to the Medical Faculty of the University and the Gandhi Memorial Hospital. It is situated in the Chattar Manzil Palace, which has been very cleverly adapted to be in keeping with a modern laboratory without destroying the main architectural features. A modern animal house, in good keeping with the architecture of the palace, has recently been added in a suitable position on the other side of the fine gardens. This was an essential addition.

The work of the Institute had the advantage of being started under the direction of the late Sir Edward Mellanby, F.R.S., for many years head of the Medical Research Council of Great Britain. Sir Edward only undertook the direction for a brief period and Lady Mellanby shared in the task. Subsequently, Dr. B. Mukerji has been in charge of the Institute. Dr. Mukerji is an authority on the active principles of plant products, and is developing the work of the Institute so that the main object may be achieved: the systematic survey of the therapeutic value of the medicinal plant resources of India. A great variety of plant and other products have been used in the past. Some are of definite therapeutic value; some are of very doubtful importance. Some interesting results have been obtained on extracts from Rauwolfia species. This plant yields many different alkaloids, one of which has been found to lower blood pressure. The proper value of these drugs is being determined in curing or preventing disease in comparison with other known drugs. The Institute seemed to us commendably unique in that this work has been undertaken as a national problem. In

many countries drug research has been mainly carried on in industrial laboratories.

The main work of the Institute necessarily gives rise to many subsidiary investigations involving botany, biochemical and bio-physical studies, organic chemistry, microbiology and parasitology, pharmacology, chemotherapy and experimental medicine. The direction of a laboratory of this kind which involves knowledge of so many branches of science, and in which priority has to be given to the work which is most worth while, is inevitably difficult. The Director has to keep abreast of the latest researches in many sciences which are advancing very rapidly, and members of the staff need to be supplied with means to attend conferences abroad. In such a wide field, concentration on certain problems is no doubt necessary. Work scattered over too wide a field may lack the tremendous detail and cross-checking which is required to establish and follow up the discovery of a new scientific fact.

In all places M. Dupouy and I stressed the need for excellence in one particular field of study; excellence is what matters. When a laboratory gets on the crest of the wave of the advance of science even in any narrow field, its reputation is made, for then the work is necessary for the advance of other work in other laboratories all over the world; workers quickly recognise the need to keep in touch with a place where new knowledge is being born. The successful director knows just how to dispose his forces, how much effort to continue to spend on a not too fruitful line of work. Sometimes, however, sheer doggedness in research is suddenly and unexpectedly rewarded.

Most big new developments have come round unexpected corners. Paul Valéry wrote that 'the human mind is absurd in what it seeks, but great in what it finds'. The President of the Council of Administration of the firm of du Pont de Nemours, U.S.A., stated in his survey 1952, 'we spend yearly 2·8 per cent of our gross income on scientific research, we take out one patent daily and we believe that by 1970, sixty per cent of our gross income will come from products which are at present totally unknown or on which research has hardly begun to-day'.

### THE NATIONAL BOTANIC GARDENS, LUCKNOW

We shall complete our tour on the 12 new Council laboratories by a visit to the National Botanic Garden. The towers and minarets of Lucknow are the score to which the colour of the flowers adorning the gardens supply the music.

In March, 1953, the Governing Body of the Council of Scientific and Industrial Research approved the scheme for taking over the Sikander Bagh Gardens from the Government of Uttar Pradesh. This is an old botanical garden, established originally by the East India Company, but its merit as a botanical garden had dwindled in course of time. Nevertheless, it can be brought into a good state with little difficulty. On 1st May, 1953, the garden became the National Botanical Garden. Mr. K. N. Kaul, who has spent a number of years on botanical research and has the experience of having worked in the botanical gardens at Kew was appointed Director.

The garden will contain a living collection of medicinal plants, of which over five hundred species are being grown, along with a herbarium; these will be an asset in the development of drug research at the Central Drug Research Institute, which is near by. The garden is being reshaped. Greenhouses and an artificial lake are under construction. Fruit groves are being improved and different graft varieties of mango, citrus and other fruits are being raised. The garden will also provide opportunities for improvement of horticultural and medicinal plants in order to increase the yield of active principles and essential oils. It is an interesting addition to the scientific institutions under the C.S.I.R., as it provides wide scope for valuable research in the plant world. It should also become a source of delight to the citizens of Lucknow and its visitors. Bhatnagar's vision of the future of these gardens and their usefulness in the hands of the C.S.I.R. to India will perhaps some day come to be as true as that of Sir Joseph Banks when he helped to establish the Royal Gardens at Kew.

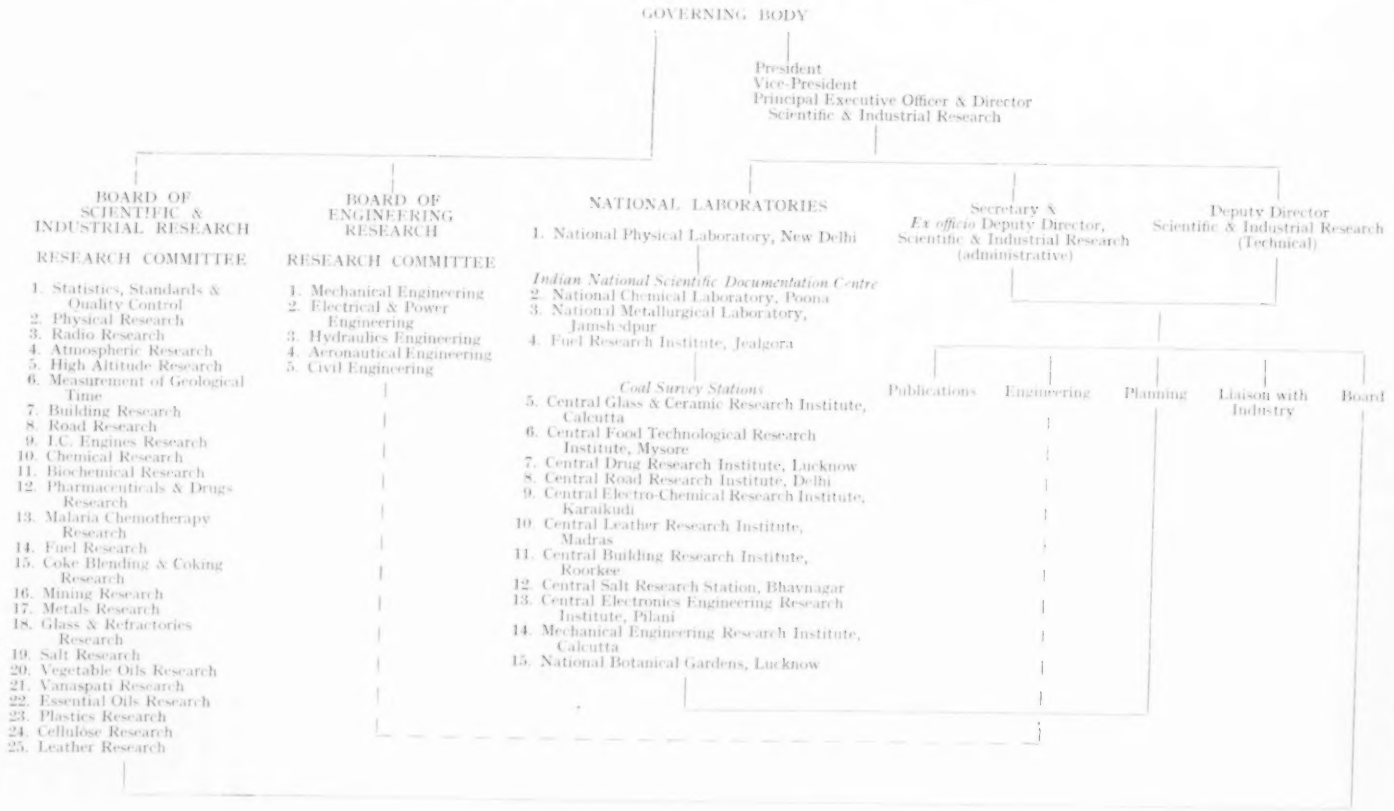
We are back in Delhi. In taking stock I think you will agree that the creation of this chain of laboratories in so short a time, and the organization it has involved, is a fine achievement. It has provided the young Indian scientist with the means to show his mettle; and the best memorial to India's great public servant, the late Sir Shanti Bhatnagar, is that good work shall be done in these grand institutes, and that they should be well maintained.

I have faith in India's young scientists and technologists; that with initiative and integrity, patience and persistence, they will be well able to fulfil their trust. One of the delights of my visit last year was that in many centres I came across keen young men, some of whom had been students in our laboratory at the Imperial College.

The new Central Office of the C.S.I.R. to which we now return, is also a fine new building. The Prime Minister, who is President of the Governing Body of the Council, a body of 21 members, invariably attends the meetings. The Council is an autonomous body administering the Industrial Research Fund and the President is vested with wide powers in the matter of the finance within the sanctioned budget allowance. The Council is attached to the Ministry of Natural Resources and Scientific Research for purposes of administration; it is advised by two bodies, the Board of Scientific and Industrial Research and the Board of Engineering Research. The Research Committees, under the Boards, are thirty in number and cover a wide range of subjects. In 1952–53 110 schemes of research were sponsored in 57 different centres with grants amounting to a total of Rs. eight lakhs. (See Table II.)

There are arrangements—such as a liaison officer and a co-ordinating committee of directors of laboratories—so that the work of the Council is well knit together and with the programmes of other laboratories, with industry's needs and with research schemes sponsored by the Council through universities and other bodies. Some of our recommendations were directed towards strengthening this co-ordination, particularly with other research activities (Agricultural and Medical), and at the same time decentralizing the administration of the laboratories as far as possible, and giving more responsibility to the individual

TABLE II: COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH


GOVERNING BODY
President
Vice-President
Principal Executive Officer & Director
Scientific & Industrial Research
BOARD OF SCIENTIFIC & INDUSTRIAL RESEARCH
RESEARCH COMMITTEE
1. Statistics, Standards & Quality Control
2. Physical Research
3. Radio Research
4. Atmospheric Research
5. High Altitude Research
6. Measurement of Geological Time
7. Building Research
8. Road Research
9. I.C. Engines Research
10. Chemical Research
11. Biochemical Research
12. Pharmaceuticals & Drugs Research
13. Malaria Chemotherapy Research
14. Fuel Research
15. Coke Blending & Coking Research
16. Mining Research
17. Metals Research
18. Glass & Refractories Research
19. Salt Research
20. Vegetable Oils Research
21. Vanaspati Research
22. Essential Oils Research
23. Plastics Research
24. Cellulose Research
25. Leather Research
BOARD OF ENGINEERING RESEARCH
RESEARCH COMMITTEE
1. Mechanical Engineering
2. Electrical & Power Engineering
3. Hydraulics Engineering
4. Aeronautical Engineering
5. Civil Engineering
NATIONAL LABORATORIES
1. National Physical Laboratory, New Delhi
Indian National Scientific Documentation Centre
2. National Chemical Laboratory, Poona
3. National Metallurgical Laboratory, Jamshedpur
4. Fuel Research Institute, Jealgora
Coal Survey Stations
5. Central Glass & Ceramic Research Institute, Calcutta
6. Central Food Technological Research Institute, Mysore
7. Central Drug Research Institute, Lucknow
8. Central Road Research Institute, Delhi
9. Central Electro-Chemical Research Institute, Karaikudi
10. Central Leather Research Institute, Madras
11. Central Building Research Institute, Roorkee
12. Central Salt Research Station, Bhavnagar
13. Central Electronics Engineering Research Institute, Pilani
14. Mechanical Engineering Research Institute, Calcutta
15. National Botanical Gardens, Lucknow
Secretary &
Ex officio Deputy Director, Scientific & Industrial Research (administrative)
Deputy Director Scientific & Industrial Research (Technical)
Publications
Engineering
Planning
Liaison with Industry
Board

boards and directors of the laboratories. India is a big place and it is not so easy as in England to gather people together for frequent consultation.

A journal, *The Journal of Scientific and Industrial Research*, is published by the Council, and also a *News Bulletin*. The compilation of a dictionary of Indian raw materials and industrial products—an encyclopædia of the wealth of India—was one of the projects about which Sir Shanti Bhatnagar was very keen. There was once a *Dictionary of Economic Products*, compiled by George Watt; this new encyclopædia is an effort to fully implement Watt's ideals. So far the work for eight volumes out of a probable ten has been completed and favourably reviewed.

The Information Service (Insdoc) which has been organized under the Council, and centred in the library of the National Physical Laboratory at Delhi, is an example of putting into practice the findings of the International conferences on documentation which have been held in recent years; there was the one organized by the Royal Society, about which I spoke when I last lectured here, and also there have been various Unesco conferences on the subject. The Information Centre includes a technical and scientific library, an information service, a document procurement service and a translation service, along with abstracting, classifying and photographic reproduction services. These should render very much more efficient the work of the Council in providing information in reply to enquiries from outside or inside the organization. In these days of tremendous activity in scientific research, these information and intelligence centres are becoming of great importance. This is perhaps particularly so in a country like India, which needs to keep in close touch with scientific work in Europe and America. They also help to get the results of research quickly implemented.

Most industrial concerns in India are too small as yet to maintain research departments of their own, nevertheless some industries, like the textile industry, are extensive. The Council has been interested in educating industry to realize the advantages which can accrue through the formation of co-operative research associations. Three have been formed in the textile industries—the Ahmedabad Textile Industry's Research Association, the Silk and Art Silk Mills Research Association (Bombay) and the South India Textile Industry's Research Association (Coimbatore).

As industry develops, the number of industrial laboratories, like the Shri Ram Institute at Delhi, may increase and there may be need for reorientation of the relationship of the Government laboratories to industry, but I believe that the fine Government laboratories, if kept in close touch with industry and made use of by industry, will provide the main requirements for many years; though other laboratories may have to be added to the list.

There are already some which I have not mentioned, the Central Salt Research Institute under Dr. Mata Prasad's direction which has been opened at Bhavnagar, the Electronics Research Laboratory which is being erected at Pilani, and the Central Mechanical Engineering Research Laboratory for which plans had been made. The latter is particularly related to the development of machinery and tools to aid the development of cottage industries.

It is quite likely that the Government may decide to develop the biological sciences further. Although there are organizations relating to the surveys for zoology (1911), for botany (1912), and for geology (1840), there is need to encourage progress in the biological sciences, for India is rich in material for study. In our report we put in a plea for special attention to astronomy and meteorology, and to physiology, and to the development of the engineering sciences.

A Board of Engineering Research was established in 1950 as an Advisory Body to the Council parallel to the Board of Scientific and Industrial Research. The Board set up five committees: Hydraulic Engineering; Electrical and Power Engineering; Mechanical Engineering; Aeronautical Engineering; Civil Engineering.

Research in engineering subjects had not made much headway in India, although various engineering colleges had long been training engineers. Engineers of high standing had been provided for the many large engineering (civil, mechanical, electrical and telecommunication) undertakings, irrigation and power schemes, and more recently developments in the production of machine tools, electronic equipment, engines and even aircraft.

The Board was established to initiate and guide research in various branches of engineering and to extend financial aid for such purpose. With a view to stimulate research activities, the Board invites proposals from individuals and research organizations, such as those under the Central Board of Irrigation, the Central Water and Power Commission, the Railway Board, the Central Electricity Board, the new Indian Institute of Technology (Kharagpur), the Indian Institute of Science (Bangalore), the Engineering College at Sidpur and Jadavpur, and the Engineering University at Roorkee. Few of the colleges teaching engineering have facilities for research, but the Reviewing Committee was of the opinion that the Higher Technological and post-graduate research institutes, for instance the Indian Institute of Science, would be highly suitable places in which to foster engineering research. Research work in power and irrigation engineering is mainly carried out under the Central Board of Irrigation and Central Water and Power Commission.

There are difficulties in attracting young men to spend years at research to the detriment of their engineering career so far as salary and other opportunities are concerned. The same happens, however, in other more industrially advanced countries and many of the brighter young men are attracted to remain in the institutes where engineering research is carried out, because of their interest in working at problems which bring them right to the forefront of engineering progress. This means that when they go into industry (having, of course, previously had some engineering workshop and other experience in industry) they are specially qualified to solve the problems which arise and often get quick promotion. It is necessary, however, that the industrial firms should be sufficiently well disposed to research and to adopting new methods to take advantage of the value of such men and give them good prospects.

The Reviewing Committee felt that there is much scope for mechanical and

electrical and telecommunication engineering research to aid in the development of the industries of India, and that it should not be difficult to encourage such work, for almost any problem arising in industry can be studied scientifically and can provide an interesting subject for research if the problem is well conceived at the outset. The facilities for carrying out research in the various C.S.I.R. laboratories and institutes and in the Bangalore Institute, and other places, are good. The difficulty, however, may be to find the investigators with initiative, zeal and the power to carry things through who are willing to take risks about their careers.

Nothing has been said here about scientific research in relation to the Ministry of Health—medical research—nor about agricultural research, both immensely important for India. I felt that there should be closer integration of these aspects of research with the Council's work. I have seen something of the medical research which is going on in the Haffkine Institute in Bombay, in Dr. Khanulkar's laboratory at the Tata Cancer Research Institute, in the Nutrition Laboratory at Coonoor, the Malaria Control centre in Delhi, and I know well how keen the Minister of Health (Raj Kumari Amrit Kaur) is on all that they do.* But I have no special knowledge of these branches of science, and you must forgive the omission of a large section of the Indian research effort. Much the same applies to the agricultural research work. I enjoyed seeing the great Forestry Institute at Dehra Dun which is famous throughout the world and has been a great boon to India. The trees of India are tremendously important sentinels against denudation, as well as a most valuable asset.

I have said nothing either about the scientific work of the universities, or the technological colleges (for instance the college in Bombay where research has thrived for many years), nor about the scientific societies—the Royal Asiatic Society of Bengal founded by Sir William Jones, F.R.S., in 1784, the National Institute of Sciences, the Indian Science Congress, and other societies. India is rich in scientific activities (see Appendix III, National Institutes and Laboratories for Research). About the 29 universities (see Appendix I) there is, of course, a great amount to be said, and there are many problems. Bhatnagar had become Chairman of the Central Government's University Grants Committee which had not long been in existence and his guidance will be missed.

I will end with the last paragraph of our report:

> We can pay homage to the work which has been done in such a short time, and to the conception of the plan under which it has been accomplished, viz. through the establishment of the C.S.I.R. and the chain of national laboratories. Every country has to adapt itself in its own way to keep abreast of the advance of knowledge and to apply it for the welfare and the betterment of the economic and social conditions of its inhabitants. India, realizing that the future of a great nation lies before it and not behind it, has gone forward. No praise is too high for the executive ability with which Dr. Bhatnagar has given shape to the Prime Minister's determination to bring science well to the fore in India's plan for the future.

*There are thirty-three Medical Colleges, two Medical Schools, six Dental Colleges, and five other Institutions which give training in the allopathic system of medicine.

India's opportunities are tremendous and it is not perhaps quite realized how quickly things are moving there. India has remained a member of the Commonwealth. The destiny of our western workshop here is still closely linked with the great country with which we have been friends for hundreds of years and which perhaps of all countries at the present time holds the keys of man's destiny. The civilization of the future will perhaps develop neither from the extreme technology of the west nor in the direction of despotic communism, but in the hands of those whose ancient traditions and spiritual insight can perhaps give a new impetus to the forces which shape man's future.

## DISCUSSION

THE CHAIRMAN: I am sure you would all wish me to express to Sir Alfred the pleasure with which we have listened to him and our gratitude to him for the time and the care which he has devoted to the preparation of a most interesting, comprehensive and informative lecture.

I expect you would all admit to having learnt a great deal from what Sir Alfred had to say this evening. I certainly have. I had an opportunity during my stay in India of getting to know a good many Indian men of science, such as Saha, Bose, Raman, and, of course, the late Sir Shanti Bhatnagar. I never had any doubt at all as to the Indians' natural talent, or as to their standard of individual achievement. Indeed, I have often thought that they are in many ways intellectually our superiors, but what was entirely new to me, and most revealing, in the lecture to which we have just listened, was the obviously most remarkable development that has taken place, perhaps under the spur of independence, in the co-ordination, organization and development of scientific studies. I had no idea at all that so much was being done. There are, of course, as Sir Alfred has said, already in existence a number of notable institutions, but the nation-wide co-ordination of effort that has been revealed by Sir Alfred's lecture was to me a revelation, and of the greatest possible interest. I feel quite sure that what we have heard this evening must be a source of great satisfaction to Mrs. Runtz. She must be truly delighted to find the purpose with which she established this series of lectures so splendidly sustained.

I would now ask you to accord in the usual way a very hearty vote of thanks to Sir Alfred.

*The vote of thanks to the Lecturer was carried with acclamation.*

SIR SELWYN SELWYN-CLARKE, K.B.E., C.M.G., M.C. (Chairman, Commonwealth Section Committee): Members of the audience who were present at the earlier lectures of this series will, I am sure, share my view that the masterly survey of research in India by Sir Alfred Egerton has set a seal on the very high standard achieved during this series. The lectures have included those by Lord Hailey, Mr. Ronald Prain, Mr. Maxwell Fry and Miss Jane Drew, Sir Hilton Poynton, and others. Members of the Commonwealth Section of this Society are extremely appreciative of the honour which you, My Lord, have done the Royal Society of Arts in presiding here this evening and I am going to ask you, Ladies and Gentlemen, to help me to express our very warm thanks to Lord Waverley for taking the chair.

*A vote of thanks to the Chairman was carried with acclamation, and the meeting then ended.*

## APPENDIX I. LIST OF UNIVERSITY INSTITUTIONS

Agra University, Agra, U.P., India.
Aligarh Muslim University, Aligarh, U.P., India.
University of Allahabad, Allahabad, U.P., India.
Andhra University, Waltair, Andhra State, South India.
Annamalai University, Annamalainagar, Madras State, South India.
Banaras Hindu University, Banaras 5, U.P., India.
Maharaja Sayajirao University of Baroda, Baroda 2, Bombay State, India.
Bihar University, Patna 4, Bihar State, India.
University of Bombay, University Road, Fort, Bombay 1, India.
University of Calcutta, Senate House, College Street, Calcutta, India.
University of Delhi, Delhi 8, India.
University of Gauhati, Gauhati, Assam, India.
Gujrat University, Navrangpura, Ahmedabad 9, Bombay, India.
University of Jammu and Kashmir, Srinagar, Kashmir, India.
Karnatak University, Post : Dharwar, Bombay State, India.
University of Lucknow, Badshah Bagh, Lucknow, U.P., India.
University of Madras, University Buildings, Chepauk, Triplicane, P.O., Madras 5, India.
University of Mysore, Mysore, South India.
Nagpur University, Nagpur, M.P., India.
Osmania University, Hyderabad, Deccan 7, India.
Punjab University (India), Solan, Simla Hills, India.
University of Patna, Patna 5, Bihar State, India.
University of Poona, Ganeshkhind, Poona 7, India.
University of Rajputana, Sawai Mansingh Highway, Jaipur, Rajasthan, India.
University of Roorkee, Roorkee, U.P., India.
University of Saugar, M.P., India.
University of Travancore, University Buildings, Trivandrum, India.
Utkal University, Cuttack 3, Orissa, India.
Visva-Bharati University, P.O. Santiniketan, District Birbhum, West Bengal, India.

## APPENDIX II. CENTRAL COUNCILS

The Indian Council of Medical Research (New Delhi)
The Indian Council of Scientific and Industrial Research (New Delhi).
The Indian Council of Agricultural Research (New Delhi).
The Indian Atomic Energy Commission (Government of India).

## APPENDIX III. NATIONAL INSTITUTES AND LABORATORIES FOR RESEARCH

1. The Ahmedabad Textile Industries Research Association, Ahmedabad.
2. The South Indian Textile Mills Research Association, Coimbatore.
3. The Silk and Art Silk Mills Research Association, Bombay.
4. The Central Cotton Technological Laboratories, Maturga, Bombay.
5. The Coconut Research Station, Travancore.
6. The Indian Lac Research Institute, Namkum, Ranchi, Bihar.
7. The Tobacco Research Station, Guntur, S. India.
8. The Bose Research Institute, Calcutta.
9. The River Research Institute, Alipore, Calcutta.
10. The Research Laboratory, Ahmedabad.
11. The Central Sericultural Research Station, Berhampore.
12. The Birbal Sahni Institute of Palæobotany, Lucknow.
13. The Hyderabad Engineering Research Laboratory, Hyderabad.
14. The Jute Research Laboratory, Calcutta.
15. The Tocklai Tea Research Experimental Station, Cinnamara, Assam.
16. The Indian Statistical Institute, Calcutta.
17. The Indian Meteorological Office, Poona.
18. The Central Laboratories of Scientific and Industrial Research, Hyderabad.
19. The Buildings and Roads Research Laboratory, Karnal.
20. The Luxminarayan Institute of Technology, Nagpur.
21. The Indian Institute of Technology, Kharagpur.
22. The Central Drug Laboratory, Calcutta.
23. The Drug Research Laboratory, Jammu.
24. The Indian Institute of Sugar Technology, Kanpur.
25. The Indian Veterinary Research Institute, Izatnagar.
26. The Central Research Institute, Kasauli.
27. The Pasteur Institute, Coonoor, Shillong and Patna.
28. The Haffkine Institute, Bombay.
29. The School of Tropical Medicine, Calcutta.
30. The Archæological Survey of India, Dehra Dun.
31. The Indian Dairy Research Institute, Bangalore.
32. The All India Institute of Hygiene and Public Health, Calcutta.
33. The National Physical Laboratory of India, New Delhi.
34. The National Chemical Laboratory of India, Poona.
35. The National Metallurgical Laboratory, Jamshedpur.
36. The National Botanic Garden, Lucknow.
37. The Fuel Research Institute, Jealgora, Bihar.
38. The Central Glass and Ceramic Research Institute, Calcutta.
39. The Central Road Research Institute, New Delhi.
40. The Central Building Research Institute, Roorkee.
41. The Central Leather Research Institute, Madras.
42. The Central Drug Research Institute, Lucknow.
43. The Central Food Research Institute, Mysore.
44. The Central Electrochemical Research Institute, Karaikudi.
45. The Central Salt Research Institute, Bhavnagar.

46. The Central Drugs Laboratory, Calcutta.
47. The Forest Research Institute, Dehra Dun.
48. The Forest Research Laboratory, Bangalore.
49. The Indian Agricultural Research Institute, New Delhi.
50. The Indian Veterinary Research Institute, Kamauns.
51. The Agricultural College and Research Institute, Coimbatore.
52. The Allahabad Agricultural Institute.
53. The Indian Institute of Animal Genetics and Nutrition, Bombay.
54. The Sheila Dhar Institute of Soil Science, Allahabad.
55. The Laboratories of the Tata Memorial Hospital, Bombay.
56. The Indian Institute of Medical Science, Calcutta.
57. The Nutrition Research Laboratory, Coonoor.
58. The King Institute, Madras.
59. The Malaria Institute of India, Delhi.
60. The Bengal Immunity Research Institute, Calcutta.
61. The Central Board of Irrigation and Power, Simla.
62. The Irrigation Research Station, Poondi, Madras.
63. The Hydraulic Research Station, Krishnaragasagar, Mysore.
64. The Irrigation Research Institute, Amritsar.
65. The Central Marine Fisheries Station, Mandapam.
66. The Central Inland Fisheries Research Station, Calcutta.
67. The Deep Sea Fisheries Station, Bombay.
68. The Botanical Survey of India, Sibpur, Calcutta.
69. The Geological Survey of India, Calcutta.
70. The Zoological Survey of India, Calcutta.
71. The Survey of India, Dehra Dun.
72. The Indian Meteorological Department, New Delhi.
73. The Central Board of Geophysics, Calcutta.
74. The Sugar Cane Research Institute, Coimbatore.
75. The Cigarette-Tobacco Research Station, Guntur.
76. The Central Tobacco Research Institute, Rajahmundry.
77. The Central Potato Research Institute, Patna.
78. The Fruit Research Institute, Bhagalpur, Bihar.
79. The Indian Institute of Sugar Technology, Kanpur.
80. The Central Rice Research Institute, Kuttach.
81. The Institute of Plant Industry, Indore.
82. The Tata Institute for Fundamental Research, Bombay.
83. The Institute of Nuclear Physics, Calcutta.
84. The Institute of Radio Physics and Electronics, Calcutta.
85. The Technical Development Establishment Stores Laboratory, Kanpur.
86. Jiwaji Industrial Research Laboratory, Gwalior.
87. Shri Ram Institute for Industrial Research, Delhi.
88. Sir Profulla Chandra Research Laboratory, Calcutta.
89. The Research Department, All-India Radio, Delhi.
90. The Buildings and Road Research Laboratory, Karnal.
91. The Ramanajam Institute of Mathematics.
92. The Solar Physics Observatory, Kodaikanal.

## APPENDIX IV. SCIENTIFIC SOCIETIES AND INSTITUTIONS

1. The Agricultural and Horticultural Society of India, Alipore.
2. The Agricultural-Horticultural Society, Madras.
3. The Anthropological Society, Bombay
4. The Bombay Natural History Society.
5. The Calcutta Geographical Society.
6. The Calcutta Mathematical Society.
7. The Entomological Society of India, New Delhi.
8. The Geological Mining and Metallurgical Society of India, Calcutta.
9. The Horticultural Society of India, Sabour, Bihar.
10. The Indian Academy of Sciences, Bangalore.
11. The Indian Association for the Cultivation of Science, Jadavpur, Calcutta.
12. The Indian Chemical Society, Calcutta.
13. The Indian Ceramic Society, Benares.
14. The Indian Mathematical Society, Madras.
15. The Indian Physical Society, Calcutta.
16. The Indian Science Congress Association, Calcutta.
17. The Indian Society of Engineers, Calcutta.
18. The Indian Society of Soil Sciences, Calcutta.
19. The Indian Botanical Society, Sangar.
20. The Institution of Chemists, India.
21. The National Academy of Sciences, Allahabad.
22. The National Institute of Sciences of India, Delhi.
23. The Mining, Geological and Metallurgical Institute of India, Calcutta.
24. The Institution of Engineers (India) Calcutta.
25. The Royal Asiatic Society of Bengal.
26. The Society of Biological Chemists, Bangalore.
27. The Society of Agriculture and Industries, Nagpur.

# *GENERAL NOTES*

## E. McKNIGHT KAUFFER MEMORIAL EXHIBITION

Old friends and admirers of Kauffer will spend many nostalgic hours in this exhibition. Younger designers and students who missed the excitement of seeing a new Kauffer Underground poster or one on the street hoardings for Shell, or Eno's, should flock to it to be fascinated and awed by the force and versatility of a master. Kauffer's success sprang from his tenacity of purpose and single-minded conviction that the highest standards of æsthetic expression must be harnessed to graphic advertising. Starting as a painter, he forsook easel art for (so-called) commercial art because he believed that such work was just as difficult and just as much worth doing as fine art. A cultured man, familiar with the art-forms of all periods, he early responded to the impact of modern art, being influenced particularly by the cubist painters Picasso and Braque. His love of cubism formed the basis of his dynamic, geometrical style.

Edward McKnight Kauffer, who was unquestionably a brilliant innovator, especially in his grasp of dramatic composition, devoted his life to designing for industry. He was awarded the first Honorary R.D.I. on its inception in 1936. With his inventiveness, colour sense and wide range of expression, Kauffer did more to raise the standard of commercial design in this country than any other working designer. The Society of Industrial Artists recognized his great contribution with an Honorary Fellowship.

This exhibition, presented by the Society of Industrial Artists with the support of the Royal Society of Arts, is not only a great tribute but also an astounding performance for one man, both in its versatility and high creative level. It was officially opened *in absentia*, by means of a recorded speech, by Mr. T. S. Eliot, O.M., an old friend and admirer of the artist. Kauffer was born in the U.S.A. in 1890 and died there in 1954. Curiously, unlike Mr. Eliot, he never took up British nationality, although he spent most of his working life in this country. His principal field was the poster. He strove to make it a work of art, in the belief that if a poster was not worth looking at it would fail to attract attention. If it was worth looking at, people would remember it and the quality of the design would enhance the public reputation of the company who had commissioned it. When the emphatic angular forms of Kauffer's posters first began to appear on the British hoardings they certainly shocked the public into attention. His artistry and, in particular, his colour sense held that attention and laid the foundations of his great reputation as an original designer, not only among the leading businessmen of the time, but among his fellow designers, art critics and students.

The first example of his work here is a poster for London Transport, *Oxhey Woods*, dated 1915. Kauffer returned to the States in 1941, and although there are a number of exhibits of his work there, the emphasis naturally is on the larger output of his quarter century in England.

The organizers are to be congratulated on the 144 works, covering posters, press advertisements, book illustrations and to a lesser extent designs for the ballet, book jackets, magazine covers, invitation cards, letter-headings, labels, and his own personal Christmas cards. A number of his originals are exhibited, not only for posters but book illustrations and costume and *décor* designs for the ballet. Of special interest to students are some examples of more personal work: small paintings and sketches done for friends, as well as thoughtful notes and experimental sketches for larger design projects.

The quality of the man and the variety of tasks he undertook with such distinction

is beautifully summarized by Sir Francis Meynell in his Appreciation in the catalogue of the exhibition. I would like to quote his concluding passage:

> Kauffer was an example of the abandoned truth that art is indivisible: that the man with the root of the matter in him can paint or design rugs or make posters or illustrate books or decorate a room or parti-colour a motorcar or scheme an advertisement with the best of the over-specialists. And although he was properly obstinate about the integrity of his work whatever it was, he had no conceit and no illusion that there was an artistic distinction between commissioned and voluntary work, between what one did for oneself and what one did for a client. Kauffer showed his culture by refusing to think that work under discipline was debased. He realized in his work and in his life the meaning of Chesterton's lines:
>
> 'There is one thing is needful: everything.
> The rest is vanity of vanities'.

ASHLEY HAVINDEN

*The exhibition, at the Victoria and Albert Museum, is open until 27th November, from 10 a.m. to 6 p.m. on weekdays and on Sundays from 2.30 to 6 p.m.*

DESIGN CENTRE

A press conference was held on 12th September, at the headquarters of the Council of Industrial Design in the Haymarket, London, to announce the future opening there of the Design Centre for British Industries, the occasion being marked by the publication of the prospectus of the Centre.

The Design Centre will, in the words of Mr. Walter Worboys, Chairman of the C.I.D., 'provide a "permanent but changing" exhibition of the contents of *Design Review*', that is, of durable consumer goods which have been selected by the Council as representative of the best of British industrial design. Mr. Worboys also emphasized that the Centre would be 'complementary to and not in competition with existing trade exhibitions'. A symbol has been designed for the Design Centre by Hans Schleger, F.S.I.A., and manufacturers will be able to use this in connection with a product which has been selected for display there.

A trade information service will also be operated at the Centre, for the benefit of home and overseas buyers, the general public, manufacturers and the press. Also, it is intended to hold, in addition to the main display, periodical exhibitions addressed to particular sections of the public, or particular trades.

The Centre, which is expected to open in the spring of 1956, will be financed in part by the firms whose goods are exhibited, and in part by the Government. It will be open on weekdays, including Saturdays, from 9.30 a.m. to 5.30 p.m., and there will be no charge for admission.

SOUTH-WEST AFRICAN ART EXHIBITION

The first collection of South-West African art to be sent overseas is at present on view at the Imperial Institute, South Kensington. The exhibition, arranged by the Southern African Association of Arts (which is 'in union with' the Royal Society of Arts), contains the work of 13 artists, most of them contemporary.

The exhibition will remain open until 23rd October, from 10 a.m. to 4.30 p.m. on Mondays to Fridays; 10 a.m. to 5 p.m. on Saturdays, and 2.30 to 6 p.m. on Sundays.

GAUGUIN EXHIBITION

The Gauguin Exhibition, which was organized by the Arts Council with the Edinburgh Festival Society and shown recently at the Royal Scottish Academy, is at present on view at the Tate Gallery, where it will remain until 26th October. Fellows will remember that the exhibition was reviewed by Nevile Wallis in his account of the Edinburgh Festival which appeared in the *Journal* for 2nd September.

The exhibition is open daily from 10 a.m. to 8 p.m., and on Sundays from 2 to 6 p.m. Admission 1*s.* 6*d.*

ROYAL PHOTOGRAPHIC SOCIETY EXHIBITION

The Royal Photographic Society is at present holding its Autumn Exhibition for which 552 exhibits have been selected out of a total of 3,500 entries from 24 countries. The exhibition will remain open until 29th October, from 10 a.m. to 7 p.m. on weekdays, at 16 Princes Gate, S.W.

TABLEWARE EXHIBITION IN PARIS

The seventh annual exhibition 'Formes Utiles', organized by the Union des Artistes Modernes, will take place at the Salon des Arts Ménagers in Paris from 25th February to 18th March, 1956. The exhibition will be devoted to table silver and cutlery, and to sets of china. The only cost to exhibitors will be the return freight charges, and the organizers hope that the display will be as international as possible. Further information can be obtained from The Secretary, Union des Artistes Modernes, Commissariat Général, Grand-Palais, Paris 8e.

## *OBITUARY*

MR. J. HOWARD WHITEHOUSE

We record with regret the death, at the age of 82, on 28th September, at Bembridge School, Isle of Wight, of John Howard Whitehouse, M.A.

Mr. Whitehouse, founder of Bembridge, whose Warden he remained until his death, was educated at Mason College, Birmingham, and at the Midland Institute. His early work, organizing social schemes for Cadbury Brothers, and his Presidency of the Ruskin Society from 1932 until his death, are indicative of his principal interests. He admired Ruskin greatly, and his long record of social work among boys shows ceaseless energy.

In 1910 he was elected Liberal M.P. for Mid-Lanark, and from 1913 to 1915 held office as a Parliamentary Private Secretary. At the outbreak of the war in 1914 he was appointed Commissioner for Belgian Refugees. After the war he founded Bembridge School, where he was able to put into operation his theories of education, but still found time for writing. Among his publications were a *Book of Homage* to Nansen, and several works on Ruskin.

Mr. Whitehouse, who was elected a Fellow of the Society in 1925, read a paper on 'Craftsmanship in Modern Education' to the Society in November, 1949, while in May, 1948, he had taken the chair at the ninth lecture in the series on 'Craftsmanship' delivered to the Society in that year.

## *NOTES ON BOOKS*

ARTIST-POTTERS IN ENGLAND. *By Muriel Rose. Faber & Faber.* 1955. 35*s*

The scope of Miss Rose's *Artist-Potters in England* is rather restricted. It consists of a 25-page critical appraisal of the art of Leach and Murray, and their associates and pupils, with chapters on the French pioneer studio craftsmen, and the Martin brothers. There is also a page of marks, and an index.

One could have wished that the term 'artist-potter' had been interpreted more liberally, and that the work of those early artist-craftsmen who touched industry at significant points, for instance William Moorcroft and John Adams, had been included. It is these, in fact, who provide the link with Morris, Crane, and the Arts and Crafts movement. The early experimental work of Moorcroft is distinctly original and personal in style. It has a quality which is distinct from that of the studio-

potters, yet is clearly the expression of an 'artist-potter' with clear views of the importance of his own work.

One feels too, especially as Miss Rose mentions the place occupied by the teaching of handmade pottery in modern general and technical education, that the work of the 'artist-teacher-potter' should have been given more adequate treatment. For example Miss Dora Billington is scarcely mentioned in the text, and her work is not illustrated. Again, there is a growing literature of the studio-potting movement, some of it important. A bibliography would therefore have been a useful addition—and in keeping with the style of the rest of the series.

The four colour plates and the 85 half-tone illustrations are carefully photographed and reproduced. They give a good idea of glaze texture and quality. The illustration of a stoneware bottle by Bernard Leach is a particularly superb example of the studio-potter's art. Miss Rose's comments are admirably detached and objective. She never over-praises. While she obviously admires Leach's work (and one can hardly wonder at that) she notes that Leach's work as a teacher and writer has tended to 'divide his energies, with the result that his pots are uneven in quality'.

Her final paragraph on Bernard Leach gives a clue to her approach to the subject, and explains, if it does not entirely justify, the rather exclusive nature of her otherwise attractive book: 'Leach, and with him Hamada, changed the English artist-potter's whole approach to his craft. By stressing the importance of the intimate understanding of raw materials which follows the preparation of bodies and glazes by the potter himself, they revealed a medium of great sensitivity of which Western artists had hitherto been largely ignorant'.

REGINALD G. HAGGAR

## *FROM THE JOURNAL OF 1855*

VOLUME III. *12th October*, 1855

### A TISSUE WOVEN BY CATERPILLARS

*From a paper on* Animal Products—The Silk Series, by P. L. Simmonds, *who quoted the following extract from a paper read by J. Dennistoun before the British Association for the Advancement of Science.*

'In the early part of this century there lived at Munich a retired officer, Lieut. Hebenstrait, who amused himself by experiments on the means of giving consistency to the gossamer produced by caterpillars, which is occasionally seen blown about in flakes over the fields in Germany, and he was at one time sanguine of rendering it available as a material for ladies' dress. It is said that his plan was to prepare a paste of lettuce or other leaves beat up with butter, and, after spreading it thinly over a smooth surface on an inclined plane, he placed at the lower end a number of chenilles or caterpillars of the proper species. These animals gradually ascended the incline, devouring the paste, and depositing as they proceeded a sort of tissue, until the whole surface was uniformly covered with it. He is reported to have produced open-work designs by drawing the pattern with a hair pencil dipped in olive oil before the animals began to work. These I never saw, but I have seen one veil on which were some letters exactly resembling a watermark on paper, the secret of which I do not know. The inventor pursued his experiments with great secrecy, in the hope of turning his invention to valuable account; but finding this impracticable, it appears that he produced but very few specimens, which are now preserved in various museums on the continent. I have seen two besides my own, which I procured at Munich, in 1837, after having advertised for it several months. The objections to using this tissue seem to be chiefly its exceedingly flimsy quality, and its very adhesive properties, which render its management and preservation extremely difficult, attaching itself closely even to the smoothest surfaces, from which it can be separated only by the

breath. My veil is about 42 in., by 24 in. One of 26½ in. by 17 in. is said to have weighed only 1½ grain. Another containing 9 square feet is mentioned as weighing 4½ grains, while the same surface of silk gauze weighed 137 grains, and of fine lace 262½ grains. It would seem that the art was in some degree known at an earlier period and occasionally practised in convents, where coloured drawings on small bits of it are said to have been made. I have seen in all four of these on the continent. . . .'

## *Some Activities of Other Societies and Organizations*

### MEETINGS

MON. 17 OCT. Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. *Railway Signalling* (Discussion).

Geographical Society, Royal, South Kensington, S.W.7. 6 p.m. Noel Ballif: *Dancers of God.*

Health, Royal Society of, at Caxton Hall, Westminster, S.W.1. 2.30 p.m. *Clean Air Bill* (Discussion).

TUES. 18 OCT. Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. *Analogues and Equivalent Circuits* (Discussion).

Industrial Transport Association, at the Royal Society of Arts, W.C.2. 6.30 p.m. E. K. Porte: *Aspects of Vehicle Insurance and Accident Assessment.*

Manchester Geographical Society, 16 St. Mary's Parsonage, Manchester, 3. 6.30 p.m. G. R. Crone: *Some Great Cartographers.*

Petroleum, Institute of, at 26 Portland Place, W.1. 6 p.m. L. H. Tarrant: *Searching for Oil in Britain.*

Physical Society, at the Science Museum, Exhibition Road, S.W.7. 5 p.m. Dr. R. Kompfner: *Travelling Wave Tubes.*

Textile Institute, at Midland Hotel, Bradford. 7.15 p.m. E. P. Sharman: *Man-Made Fibres.*

WED. 19 OCT. British Kinematograph Society, at G-B Theatre, Film House, Wardour Street, W.1. 7.30 p.m. H. V. King and A. W. Lumkin: *Magnetic Recording in Film Production.*

Eugenics Society, at the Royal Society, Burlington House, Piccadilly, W.1. 5.30 p.m. J. F. Loutit: *Biological Hazards of Nuclear Fission.*

Meteorological Society, Royal, 49 Cromwell Road, S.W.7. 5 p.m. (1) W. A. Lewis and L. H. Watkins: *Investigation into the accuracy of four types of rainfall recorder.* (2) J. S. Turner: *The salinity of rainfall as a function of a drop size.* (3) E. M. Fournier D'Albe, S. I. Rasool and I. H. Zaidi: *The cloud seeding trials in the Central Punjab, June-September, 1954.*

Victoria & Albert Museum, South Kensington, S.W.7. 6.15 p.m. John Summerson: *Robert Adam and the Adam Style.*

THURS. 20 OCT. Chemical Society, at the Institution of Civil Engineers, Great George Street, S.W.1. 7.30 p.m. Prof. M. Calvin: *The photosynthetic Carbon Cycle.*

At the University, Bristol. 7 p.m. Prof. Wilson Baker: *Organic Inclusion Compounds and their Uses.*

Incorporated Plant Engineers, at the College of Preceptors, Bloomsbury Square, W.C.1. 7 p.m. C. McL. Cameron: *The 1400 excavator.*

Physical Society, at Imperial College, Imperial Institute Road, S.W.7. 5.30 p.m. G. Mackworth-Young: *The Mechanics and Acoustics of Singing.*

FRI. 21 OCT. Chemical Society, at the University Chemical Laboratory, Pembroke Street, Cambridge. 8.30 p.m. Prof. D. H. Hey: Homolytic Aromatic Substitution.

Engineers, Junior Institution of, 14 Rochester Row, S.W.1. 7 p.m. S. A. McAuliffe: *The Atom.*

Textile Institute, at the Town Hall, Preston. 7.30 p.m. G. Landells: *Modern Developments in Textile Finishing.*

SAT. 22 OCT. Horniman Museum, London Road, Forest Hill, S.E.23. 3.30 p.m. K. C. Rosser: *A Hermit Village in the Himalayas.*

MON. 24 OCT. Kings College, Strand, W.C.2. 5 p.m. Professor H. L. A. Hart: *Causation in the Law.*

TUES. 25 OCT. Chadwick Trust, at University College, Gower Street, W.C.1. 5.30 p.m. R. J. Wilkins: *Development of the Measurement of Strains in Structures.*

Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. (1) D. R. Chick and D. P. R. Petrie: *An Electrostatic Particle Accelerator*; (2) S. E. Hunt, D. P. R. Petrie, K. Firth and A. I. Trott: *An Electrostatic Analyser for the Absolute Measurement of Proton Energies and the Establishment of Fixed Points on the High-Voltage Scale.*

Manchester Geographical Society, 16 St. Mary's Parsonage, Manchester, 3. 6.30 p.m. W. E. Gregson: *In and Around Malaya.*

WED. 26 OCT. British Foundrymen, Institute of, at the Waldorf Hotel, W.C.2. 7.30 p.m. G. Blanc and M. Jaumain: *Co-operation between Engineer and Founder on Casting Design.*

Victoria & Albert Museum, South Kensington, S.W.7. 6.15 p.m. Dr. W. Viola: *Paintings and Sculpture by Children.*

THURS. 27 OCT. Textile Institute, at 10 Blackfriars Street, Manchester, 3. 7 p.m. J. Wright: *Developments and Problems in Making-up in the Light Clothing Industry.*

FRI. 28 OCT. Engineers, Junior Institution of, 14 Rochester Row, S.W.1. 7 p.m. L. Turner: *Some problems of a structural consultant's case book.*

Mechanical Engineers, Institution of, 1 Birdcage Walk, S.W.1. 5.30 p.m. Prof. J. F. Baker and C. F. Tipper: *The Value of the Notch Tensile Test.*

Royal Institution of Great Britain, 21 Albemarle Street, W.1. 8 p.m. Sir Edward Salisbury: *Fruit and Seed Production.*

SAT. 29 OCT. Chemical Engineers, Institution of, at College of Technology, Manchester. 3 p.m. A. T. Grisenthwaite: *A review of processes for the production of hydrogen.*

Horniman Museum, London Road, Forest Hill, S.E.23. 3.30 p.m. Dr. W. E. Swinton: *The Story of Animal Flight.*

### OTHER ACTIVITIES

MON. 17 OCT. UNTIL SUN. 23 OCT. Imperial Institute, South Kensington, S.W.7. 12.30 p.m., 1.15 p.m. and 3 p.m. Weekdays, 3 p.m. and 4 p.m. Saturdays, 3 p.m., 4 p.m. and 5 p.m. Sundays. Films: *Marangu—Tanganyika*; *This World of Ours—Ceylon*; *Ruhuna National Park—Ceylon.*

WED. 19 OCT. Building Centre, 26 Store Street, W.C.1. 12.45 p.m. Film Show: *Fural Aluminium Roofing and Wall Cladding.*

MON. 24 OCT. UNTIL SUN. 30 OCT. Imperial Institute, South Kensington, S.W.7. 12.30 p.m., 1.15 p.m. and 3 p.m. Weekdays, 3 p.m. and 4 p.m. Saturdays, 3 p.m., 4 p.m. and 5 p.m. Sundays. Films: *Cave Temples* (*part* 1)—*India*; *Gold Coast People*; *Caribbean Holiday—West Indies.*

WED. 26 OCT. Building Centre, 26 Store Street, W.C.1. 12.45 p.m. Film Show: *Prestressed Concrete.*

FRI. 28 OCT. London Industrial Co-ordinating Committee: The London Industrial Accident Prevention Groups' Conference.

NOW UNTIL 23 OCT. Imperial Institute, South Kensington, S.W.7. *Exhibition of South West African Paintings.*

NOW UNTIL 27 NOV. Victoria & Albert Museum, South Kensington, S.W.7. *Memorial Exhibition of the Work of E. McKnight Kauffer.*